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MINERAL COMMODITY REPORT

--TALC AND RELATED MINERALS--

1986

CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY

SPECIAL PUBLICATION 90

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MINERAL COMMODITY REPORT

--TALC AND RELATED MINERALS--

1986

By
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WESTERN SOURCE, INC.

Part 1 from
the U.S. Bureau of Mines publication,
Mineral Commodity Summaries, 1985

CALIFORNIA DEPARTMENT OF CONSERVATION
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INTRODUCTION

This report on the availability and demand for talc* in California, the United States, and the world is one in a series of Mineral Commodity Reports prepared by the Division of Mines and Geology (DMG) to describe commodities of significance to California and the nation.

This report is an up-to-date summary of mineral information. It has two parts: (1) United States and world-wide mineral-statistic information and economic analysis, adapted directly from the U.S. Bureau of Mines "Mineral Commodity Summaries (1986)"; and (2) a section on the California minerals industry, prepared by Daniel Howard of Western Source, Inc. The U.S. Bureau of Mines presents the earliest Government estimates of non-fuel mineral-industry data, including world resource data provided by the U.S. Geological Survey.

Talc is a hydrous magnesium silicate which occurs in many localities in California. Most of the industrial talcs produced in the United States are essentially mixtures of silicates that contain appreciable proportions of magnesia. In such mixtures the mineral talc is commonly, but not necessarily, the major constituent. In current industrial usage the term "steatite" is applied to high-purity talc. The term "soapstone" usually refers to a blocky material rich in the mineral talc but containing impurities that prevent its use as a high-grade industrial talc. The desirable properties of industrial talcs are its softness, micaceous or flaky habit, slip or lubricating power, chemical inertness, high fusion point, low shrinkage, low electrical and thermal conductivity, high specific heat, and resistence to heat shock. These properties make talc useful in ceramics, as fillers and extenders for many applications, as parting or lubricating agents, and in cosmetics.

In 1985, 1,227,000 tons of talc was mined in the United States: of this total, California produced 95,000 short tons.

For further information, please call (916) 445-5716, the DMG centralized information number.

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*Includes pyrophyllite where appropriate and feasible.

PART I: UNITED STATES AND WORLDWIDE

1. UNITED STATES PRODUCTION AND USE

Talc and Pyrophyllite: There were about 30 talc-producing mines in 10 States in 1985. Montana, Texas, Vermont, and New York in order of volume, produced, together, 84% of the yearly total. Ground talc was consumed in ceramics, 37%; paints, 19%; paper, 10%; roofing, 9%; plastics, 7%; cosmetics, 5%; rubber, 3%; insecticides, 1%; and other, 9%. Total pyrophyllite production, 7% of total talc plus pyrophyllite production and all in California and North Carolina, remained static in 1985. Consumption was mainly in ceramics, 35%; refractories, 25%; insecticides, 17%; roofing, 7%; and other, 16%. The talc and pyrophyllite sold was valued at $24.2 million.

2. SALIENT STATISTICS--UNITED STATES

	1981	1982	1983	1984	1985[e]
Production, mine	1,343	1,135	1,066	1,170	1,227
Sold by producers	1,221	1,025	1,163	1,212	1,250
Imports for consumption	27	27	44	45	34
Exports	311	232	218	256	282
Shipments from Govt. stockpile excesses			N O N E		
Apparent consumption	937	820	989	1,009	1,079
Price: Crude or ground		$19 to $300 per ton			
Stocks, producer, yearend	291	401	304	250	50
Employment: Mine and mill	920	880	800	800	800
Net import reliance[1] as a percent of consumption		N e t e x p o r t e r			

3. RECYCLING

Insignificant

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e Estimate.

1 Defined as imports - exports + adjustments for Government and industry stock changes.

4. IMPORT SOURCES (1981-84)

Canada 43%, Italy 26%, Republic of Korea 6%, Other 25%.

5. TARIFF

Item	Number	Most Favored Nation (MFN) 1/1/86	Most Favored Nation (MFN) 1/1/87	Non-MFN 1/1/86
Crude, not ground	523.31	0.02¢/lb.	Free	0.25¢/lb.
Ground, washed, powdered	523.33	3.3% ad val.	2.4% ad val.	35.0% ad val.
Cut or sawed	523.35	Free		1¢/lb.
Other, n.s.p.f.	523.37	4.8% ad val.	Free	35.0% ad val.

6. DEPLETION ALLOWANCE

Block steatite talc--22% (Domestic), 14% (Foreign).
Other--14% (Domestic), 14% (Foreign).

7. GOVERNMENT PROGRAMS

On July 8, 1985, the Administration announced that the President had proposed new National Defense Stockpile goals. By December 1, the proposal was still being considered by Congress.

Stockpile Status--9/30/85
(Short tons)

Material	Goal	Total Inventory	Excess to Goal Authorized For Disposal	Sales, 9 Months
Talc, block and lump	28	1,081	63	0
Talc, ground	0	1,089	0	0

8. EVENTS, TRENDS, AND ISSUES

U.S. mine production of talc-group minerals increased 10% compared with that of 1984. Apparent consumption of talc minerals in the United States was 10% higher than in 1984. From a 1983 base, demand for talc and related minerals is expected to increase at an average annual rate of about 4.5% through 1990. It is estimated that in 1986 domestic mine production of talc will be 1.4 million tons and U.S. apparent consumption will be 1.2 million tons.

U.S. exports of talc minerals continued their growth as tonnage exported in 1985 was 10% above that of 1984 and the highest since 1981.

9. WORLD TALC AND PYROPHYLLITE MINE PRODUCTION AND RESERVE BASE

	Production		Reserve Base[2]
	1984	1985[e]	
United States	1,170	1,227	600,000
Finland	342	360	40,000
France	320	340	40,000
Italy	165	160	40,000
Japan	1,666	1,700	220,000
Other Market Economy Countries	2,304	2,400	150,000
Centrally Planned Economies	2,000	2,200	180,000
World Total (may be rounded)	7,967	8,400	1,270,000

10. WORLD RESOURCES

The United States is self-sufficient in most grades of talc and related minerals. Domestic and world resources are estimated to be approximately five times the quantity of reserves.

11. SUBSTITUTES AND ALTERNATES

In the ceramics market, talc and pyrophyllite compete with each other as well as kaolin, fuller's earth, other inorganic fillers, and feldspar. Phosphate-bonded talc is a thoroughly acceptable substitute for block steatite talc; potential alternative materials are talc bonded with magnesium oxychloride, and either phosphate-bonded or hot-pressed synthetic mica. Talc, mica, and other minerals compete for plastic (especially polypropylene) filling and reinforcing roles.

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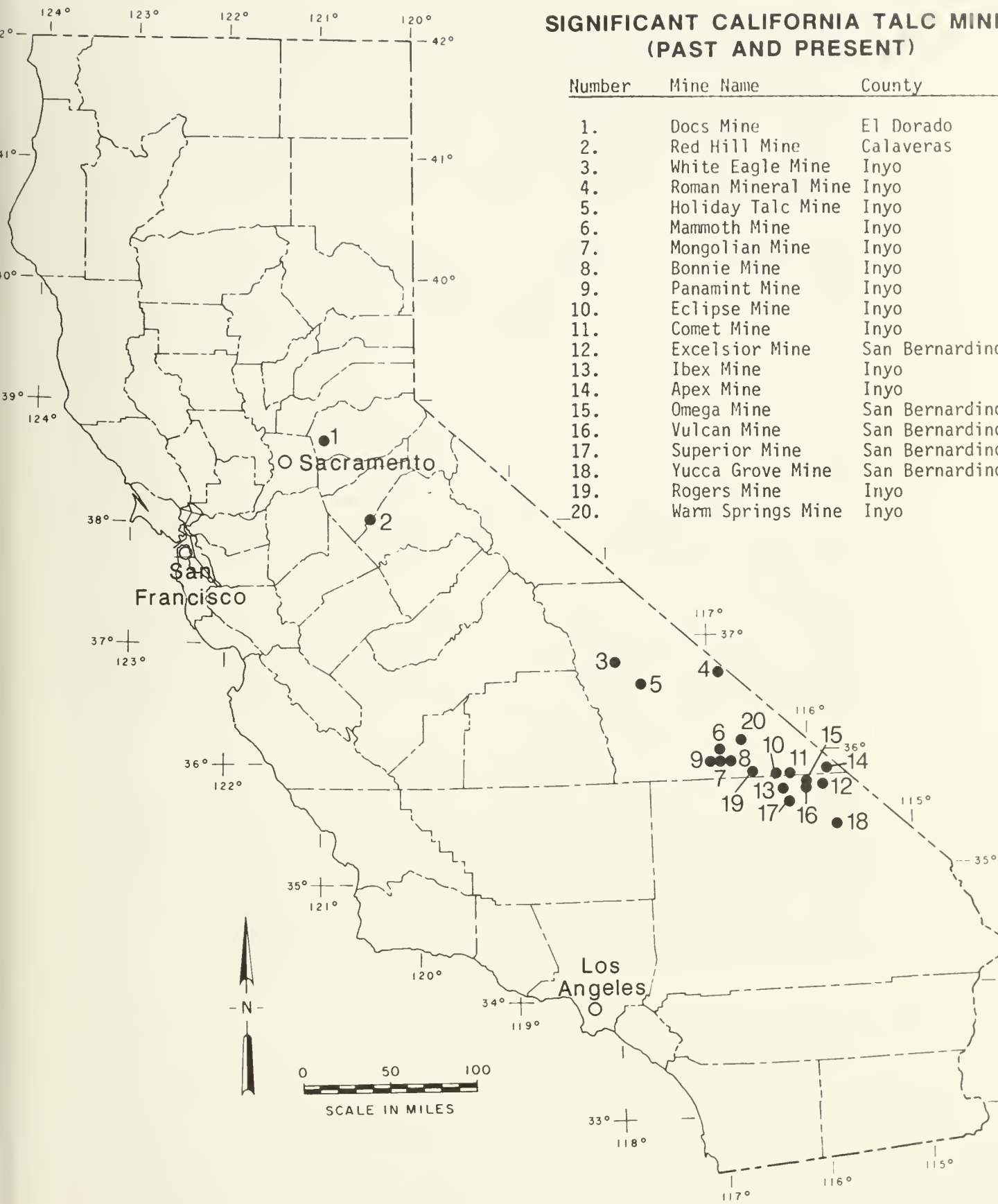
2 Reserve Base.-That part of an identified resource that meets specified criteria related to current mining and production practices including those for grade, quality, thickness, and depth. The reserve base is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources). The term "geologic reserve" has been applied by others generally to the reserve-base category, but it also may include the inferred-reserve-base category; it is not a part of this classification system.

SIGNIFICANT CALIFORNIA TALC MINE
(PAST AND PRESENT)

Number	Mine Name	County
1.	Docs Mine	El Dorado
2.	Red Hill Mine	Calaveras
3.	White Eagle Mine	Inyo
4.	Roman Mineral Mine	Inyo
5.	Holiday Talc Mine	Inyo
6.	Mammoth Mine	Inyo
7.	Mongolian Mine	Inyo
8.	Bonnie Mine	Inyo
9.	Panamint Mine	Inyo
10.	Eclipse Mine	Inyo
11.	Comet Mine	Inyo
12.	Excelsior Mine	San Bernardino
13.	Ibex Mine	Inyo
14.	Apex Mine	Inyo
15.	Omega Mine	San Bernardino
16.	Vulcan Mine	San Bernardino
17.	Superior Mine	San Bernardino
18.	Yucca Grove Mine	San Bernardino
19.	Rogers Mine	Inyo
20.	Warm Springs Mine	Inyo



PART II: CALIFORNIA

12. CALIFORNIA GEOLOGICAL OCCURRENCES

Most talc and soapstone deposits of commercial importance occur as alterations of high-magnesian rocks, principally dolomite, dolomitic limestone, and ultramafic igneous rocks. The geologic environment includes both regional and contact metamorphism. Conditions of moderate stress may have existed in the rocks as the hydrothermal metamorphism to the talc minerals occurred.

Most deposits of commercial talc are localized along shear and shatter zones. In the Silver Lake district of southern California, zones of talc schist, intimately associated with massive bodies of tremolite appear to have formed during strong rock deformation. However, much of the mineral talc in these deposits has formed in a nearly static environment subsequent to major deformation of the rocks prior to the mineralization.

The alteration of ultramafic rocks to talc involves, essentially, the hydration of olivine and pyroxene to hydrous magnesium silicate minerals of which talc ordinarily appears to be the last to form. The mineral serpentine commonly forms as an intermediate product in this progressive hydration. Talc deposits associated with ultramafic rocks intruded into metasedimentary schists and phyllites occur in northern and central California. They generally are of the soapstone variety.

The alteration of carbonate strata to talc has occurred in various geologic environments. Many of the larger deposits of this type exist in regionally metamorphosed terrane in which the mineral talc has formed at a late stage of lowered temperature. In such deposits the talc commonly has replaced tremolite which develops during an intermediate stage in the alteration. Deposits of this type occur in the Silver Lake-Yucca Grove area of San Bernardino County.

Other talc deposits have formed as alterations of relatively unmetamorphosed carbonate strata and contain little or no material composed of other magnesium silicate materials. In California, most of the deposits of steatite-grade talc, which occur in or near the Inyo Mountains of central and northern Inyo County, are of this type. Still other deposits that have been altered from carbonate strata occur as contact-metamorphic bodies along or near margins of diabase sills or dikes. Very large talc-tremolite bodies of this type occur in the southern Death Valley and Kingston Range region of California.

13. CALIFORNIA LOCALITIES

The more productive deposits in California lie in a narrow belt that extends south-southeastward for a distance of about 200 miles from the Bishop area in Inyo County to the vicinity of Baker in San Bernardino County. This belt is divisible into three areas, each containing a somewhat characteristic type of deposit.

The most southerly area of the belt is east and north of Silver Lake playa in San Bernardino County. In this area, the deposits are largely medium-grained tremolite schist, in part altered to serpentine and the mineral talc. These deposits are sheared and reconstituted zones within Precambrian marbles that have been widely invaded by granitic to mafic igneous rocks. All talc-forming processes occurred during Precambrian time. The mineable deposits occur in a zone 2 miles long with individual talc bodies ranging in length from 20 to as much as 800 feet. Most of the commercial bodies are 10 to 20 feet thick.

The principal talc deposits of the southern Death Valley-Kingston Range, Inyo and San Bernardino Counties, lie at the contact, or near the base, of a massive carbonate member in the Late Precambrian Crystal Spring Formation. Although the silication commonly has been too weak to yield vast deposits of material of commercial interest, several active mines have been developed in deposits that range in length from 1,000 feet to a mile or more, and average 20 to 25 feet in thickness. The silicated zones are mainly mixtures of talc, tremolite, serpentine, and calcite. Either talc or tremolite greatly predominates in most of the commercial rock.

Most of the talc deposits of the Inyo Mountains and northern Panamint Range, Inyo County, are associated with Ordovician and Silurian sedimentary rocks. The individual bodies of talc are lenticular to very irregular, and the largest are several hundred feet long. Unlike many commercial talc deposits, the material composing these bodies approaches the pure mineral in chemical composition, and generally is free of the tremolite that is so common in deposits of the other two districts.

Numerous deposits of talc-schist or soapstone are associated with the serpentine bodies of the western foothills of the Sierra Nevada. As the deposits are alterations of the serpentine, they generally retain several percent iron which causes the material to grind and fire to darker colors than do the essentially iron-free talcs of southern California.

Individual deposits rarely are more than 50 feet wide and 400 feet long. Only a small proportion of the deposits has been developed, as the demand for these talc resources has been limited.

Soapstone production has been recorded from properties in seven Sierran foothill counties, with recent production of industrial grade talc from Calaveras County. Individual deposits again are rarely more than 50 feet wide and a few hundred feet long and have the form of discontinuous lenses and pods essentially conformable with the prominent foliation of the enclosing metasedimentary rocks.

14. CALIFORNIA PRODUCTION

California ranked sixth among the 11 states reporting talc and pyrophyllite production in 1983. Crude talc ore came principally from six operations in Inyo and San Bernardino counties, with some production reported from one mine in Calaveras County. Processed talc production was reported from eight operations in San Bernardino, Los Angeles, Inyo, Calaveras, and Sacramento counties.

For 1985 production was estimated at 95,000 tons with a value of $2,287,000.

15. UTILIZATION AND MARKETS

A small amount of carving grade soapstone is being produced and distributed throughout the United States from a number of small properties located in the foothill counties.

Industrial talc products produced in California are marketed throughout the western United States with a small percentage exported to Canada and Mexico.

The largest market for industrial talc is as a raw material for ceramic fixtures (toilet bowls, etc). The ceramic industry requires talc that forms well when the fixtures are cast or pressed, that are uniform, and that fire white or nearly so.

Several varities of commercial talc are marketed for use as paint extenders. Talc is a desirable paint extender because it causes a low settling rate in the mixed paint, its platey particles promote durability, it permits the paint to flow readily and smoothly, and it aids in the dispersion of pigments. All talc used in paint must grind white or nearly so.

The next largest market is the plastics industry where finely ground talc is used as a filler to reduce the amount of expensive resins. Talc also adds important strength and thermal properties to the plastic products.

The rubber industry uses talc as a lubricant which is applied either as a dry powder or in a water suspension. Talc is also used as a filler in some rubber products. Talcs are used as fillers in a number of different coating and texture products in the construction industry and as fillers in some putties and cements. The asphalt roofing industry uses talc as both a filler and a sealer. Some talc is used as an insecticide carrier.

The paper industry uses finely ground talcs to lubricate the paper passed through steel rolls, as an ingredient to give opacity and brightness, and for pitch control. Cosmetic and pharmaceuticals require white, chemically pure talc of the highest quality.

16. MINING METHODS AND BENEFICIATION

Talc is generally quarried by ordinary surface mining methods, however a small amount of talc continues to be mined by underground methods. Selective mining techniques are employed to reduce contamination by associated mineral impurities depending upon the market for which the product is intended.

Talc is crushed, ground, and classified into various products sized to meet the particular specifications of each market use.

As talc ore is one of the softer rock types, products are usually ground with roller mills. Some of the finer ground products supplied to the paint and plastics industries as fillers and extenders may require additional beneficiation.

17. CALIFORNIA EVENTS, TRENDS, AND ISSUES

A strong contruction industry and the healthy business climate existing for the past few years have resulted in an increased demand for industrial talcs.

The recent closure of a major talc mine will effect the short term production of talc in California. Supplies from Montana and Texas will replace a portion of the lost production. The operator cited depletion of ore reserves and OSHA restrictions on the use of tremolitic talc as reasons for the closure.

Although talc reserves are large and the United States is self-sufficient in this commodity, environmental issues, increased restrictions, and land use competition have adversely affected mining costs. These increased costs have now made substitute minerals and imported products more attractive in some market areas.

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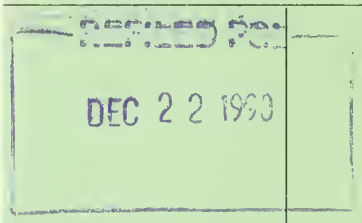

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